

Cosmic Ray – Activity
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For Elements 2002 Workshop

**Cosmic Ray
Lessons and
Activity**

(Thanks to Beth and Ilan
for their time in
working this through)

The Power Point *Cosmic Rays* can be viewed at this time, or another convenient time through the process..

Concept Keys:

Three main ideas prevail in this concept:

1. The source of the rays.
2. The probability that they will collide.
3. The consequences of collision.

I. Source

Thanks to Mike Muise and Mark Power for their consultation time for this one.

Sunspots are a source from which high energy electrons and protons leave and penetrate the magnetosphere of Earth. (More detailed information is available in the Power Point: *Cosmic Rays*). The acceleration is created by an explosion. The particles will not gain any more energy, except after (extremely rare) collisions with another high-energy particle. The motion is analogous to a bullet.

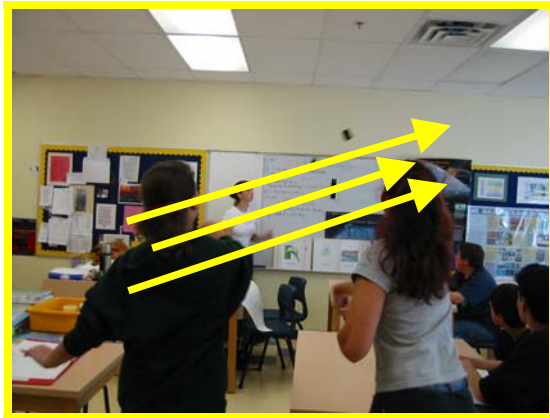
2. Probability

a) Students will be invited to undertake the following activities:

- i. First they will be invited to throw either small balls of varying sizes or Velcro balls at a small target across the room. (Thanks to Eric for his Velcro suggestion). Students will try this first with one ball from varying positions, and then with two, or three, requiring that all balls hit the same target at the same time.



- ii. Students will be invited to predict the probability of a “hit” in all instances; will discuss factors involved in the success or failure of hits to occur, and will discuss and record the rate of hits, and outcomes related to position and number.
- iii. Tennis balls stick fairly well without wrapping in Velcro, as long as you have the receiving pics mounted for them to catch.



3. Connection

At this time, students will be presented with various resources dealing with the Northern Lights (a phenomenon with which most students in this area are familiar). This will be related to cosmic rays.

Northern Lights: (notes):

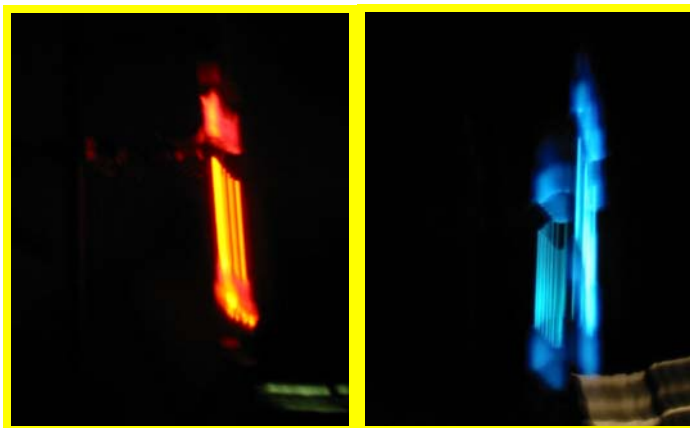
- High speed charged particles enter Earth's atmosphere
- They collide with atmospheric gas atoms such as nitrogen and oxygen
- Collision causes excitation of electrons
- Light energy is given off
- The light is the Aurora
- The colour depends upon 1) the gas involved 2) how highly excited the particles are

Activity

(Courtesy Mark Power – ParkView Education Center, Bridgewater, Nova Scotia)



- Tubes are filled with particular gases, in this case, neon and mercury.
- In a dark room, a voltage (1000 v battery) was applied.
- Electrons were accelerated through the gas, causing collisions, and light.



4. Consequences of collision:

a) Students will be asked to undertake the following activities:

- i. Using Ilan's black box (Gary is building one, and I am

	<p>looking into getting one built for my own school) attempt to have bubbles collide.</p> <p>ii. In both instances, students will be asked to observe the instances of collision (probability, again) and the results when collision takes place. What happens, and why?</p> <p>iii. The varied results will be compared to varying resulting colours created in the Aurora</p>
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